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Kirby, Jr.

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[54] **INK FOUNTAIN AND SUPPLY SYSTEM FOR A PRINTING PRESS**

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[73] Assignee: **Monarch Marking Systems, Inc.**, Dayton, Ohio

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Related U.S. Application Data

[62] Division of Ser. No. 411,283, Oct. 31, 1973, Pat. No. 3,901,150.

[52] **U.S. Cl.** **101/366;** 222/385

[51] **Int. Cl.²** **B41F 31/08;** B67D 5/46

[58] **Field of Search** 101/350, 366, 351, 363, 101/367; 222/321, 385; 417/554

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[57] **ABSTRACT**

A printing plate is mounted on a driven print cylinder, and ink is applied to the face of the plate by an ink applying roll which forms a nip with an ink distributing roll positioned below and horizontally offset from the ink applying roll. The rolls are driven in timed relation by a set of connecting gears and are adjustable as a unit independently on opposite ends for selecting precision uniform contact of the ink applying roll with the printing plate. In addition, the ink distributing roll is adjustable on opposite ends independently relative to the ink applying roll for precisely adjusting the nip between the rolls without changing the drive relationship. The ink is supplied to the rolls by an ink recirculating pump actuated by a cam driven by the same motor which drives the print cylinder, the ink rolls and an optional web cut-off unit. The ink recirculating pump includes a reciprocating plunger-type ink supply tube disposed concentrically within an ink return tube, and the concentric tubes depend from a manifold and cap assembly into an ink supply container. A set of molded plastic check valve bodies snap-fit onto the lower end portions of the concentric tubes, and reciprocation of the inner valve body within the outer valve body produces a flow of ink upwardly through the ink supply tube while excess ink returns between the inner and outer tubes.

7 Claims, 10 Drawing Figures

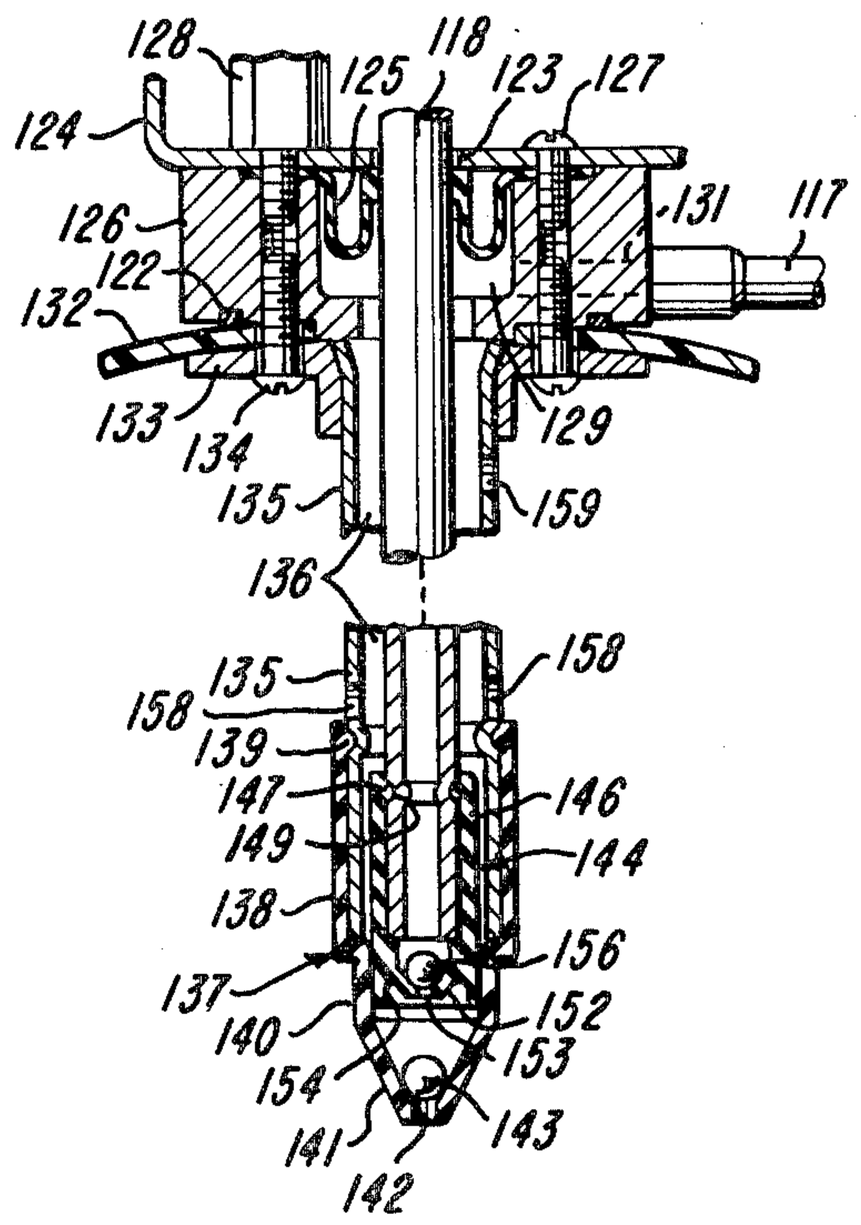


FIG-1

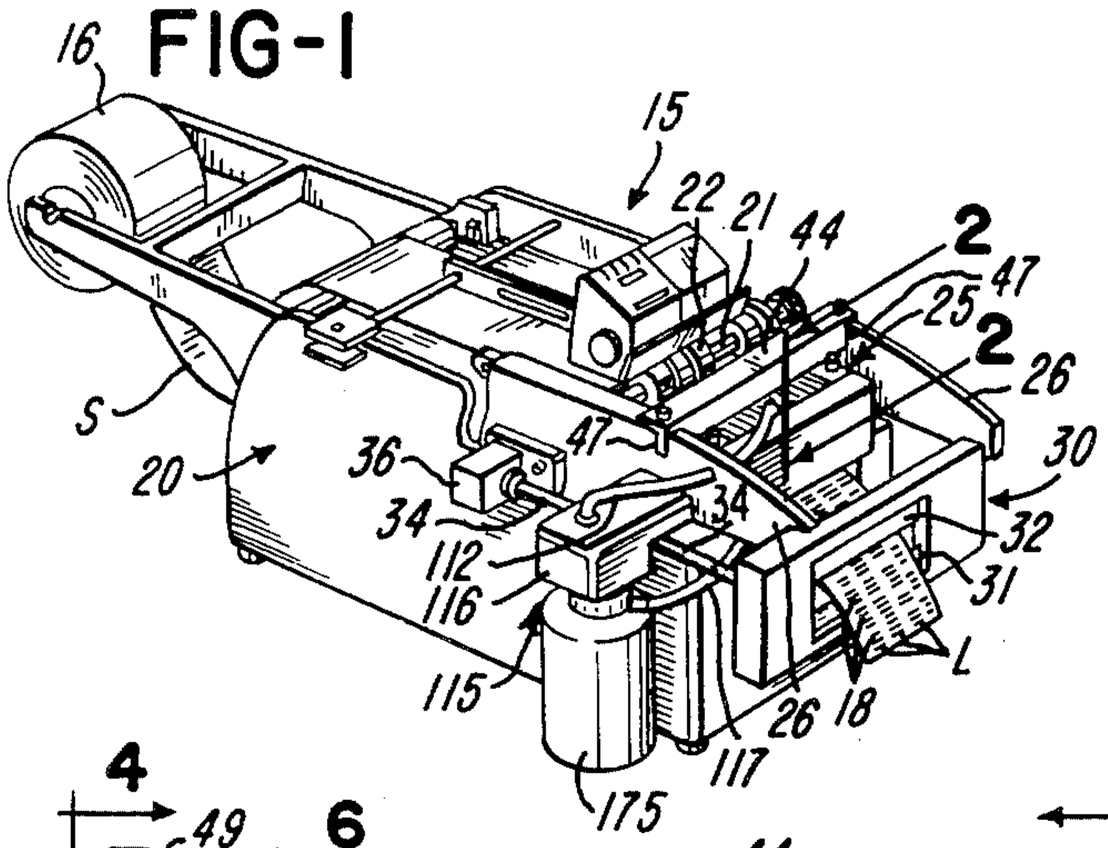


FIG-2

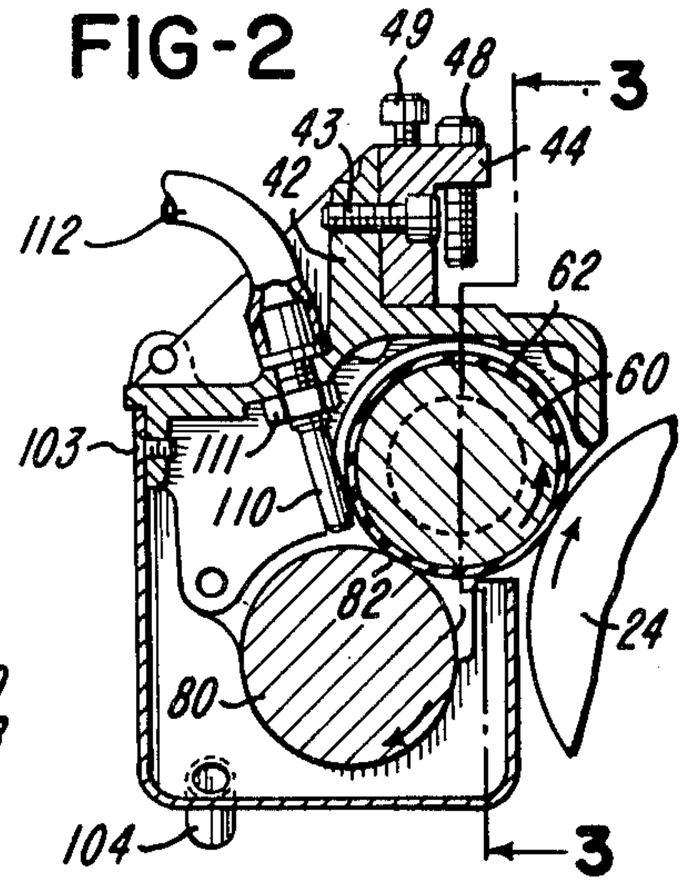


FIG-3

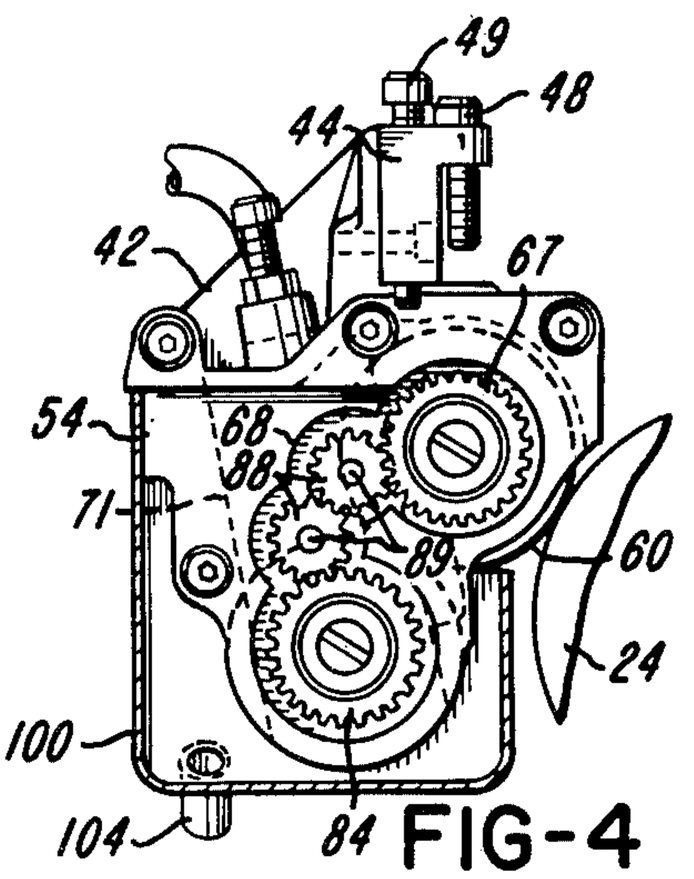
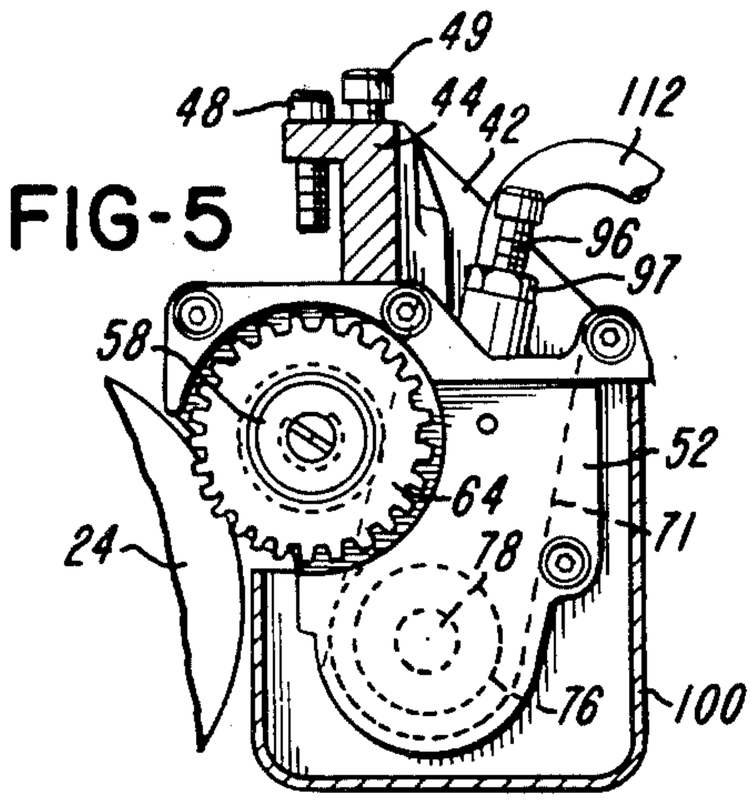


FIG-4

FIG-5



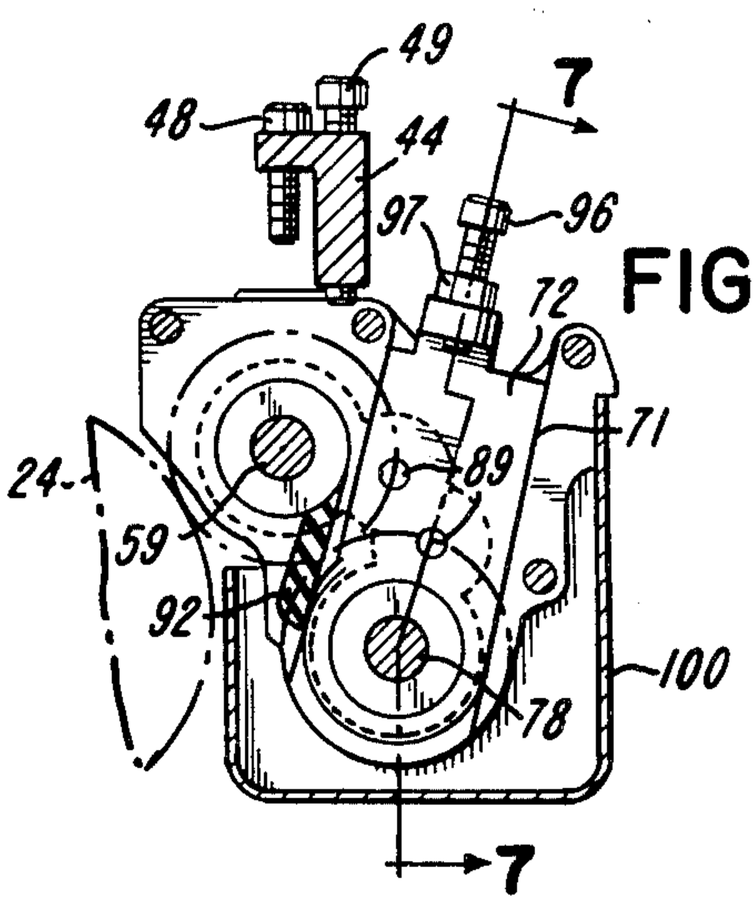


FIG-6

FIG-7

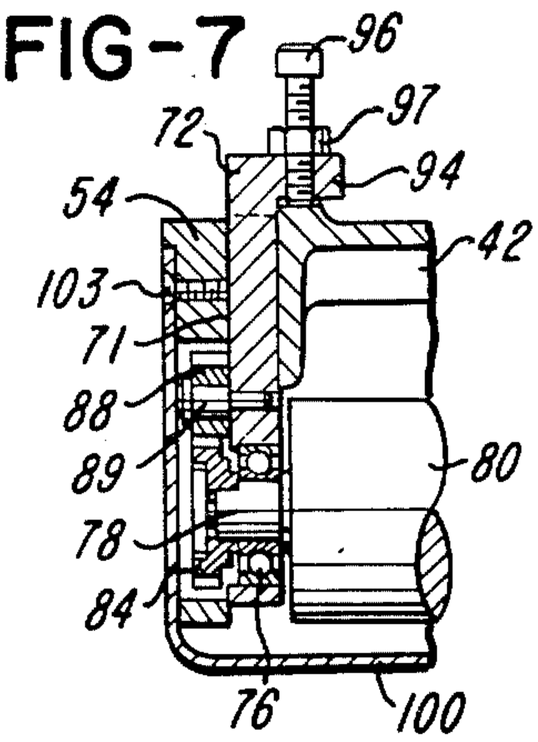


FIG-8

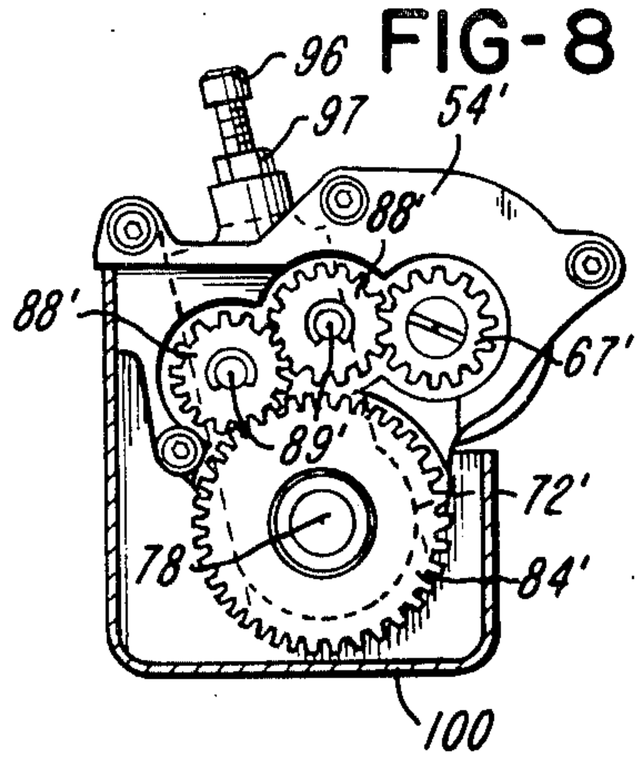


FIG-9

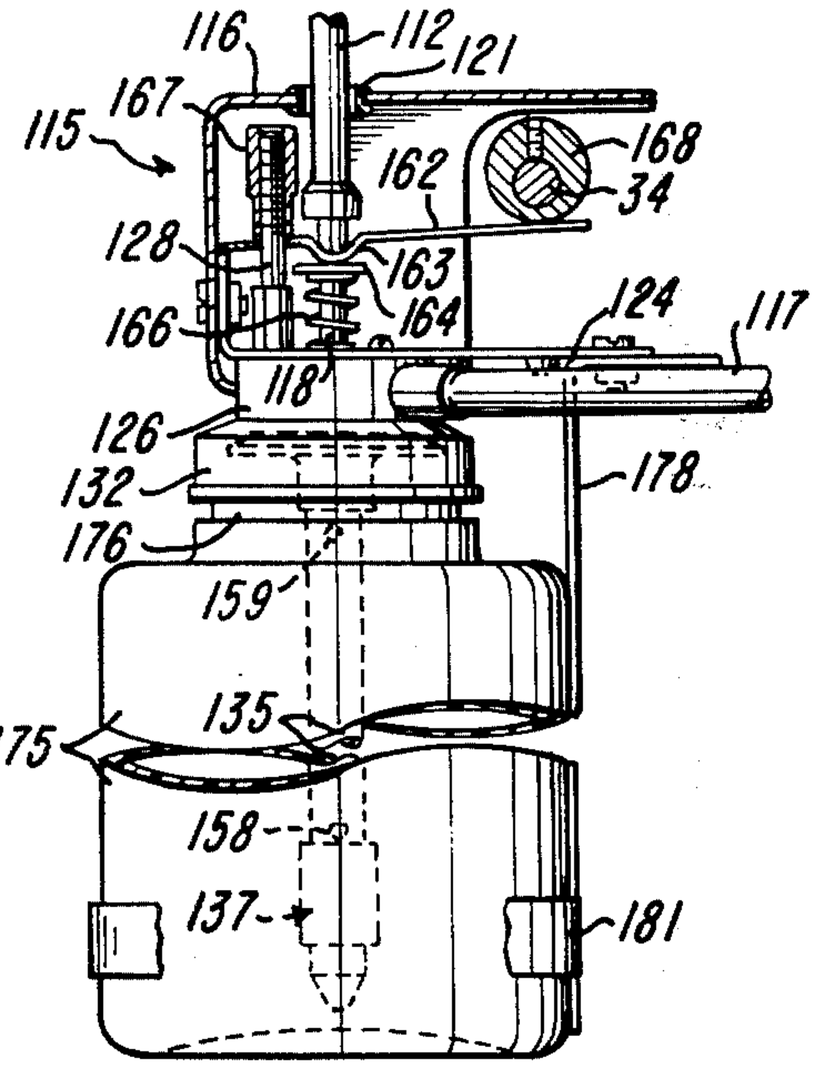
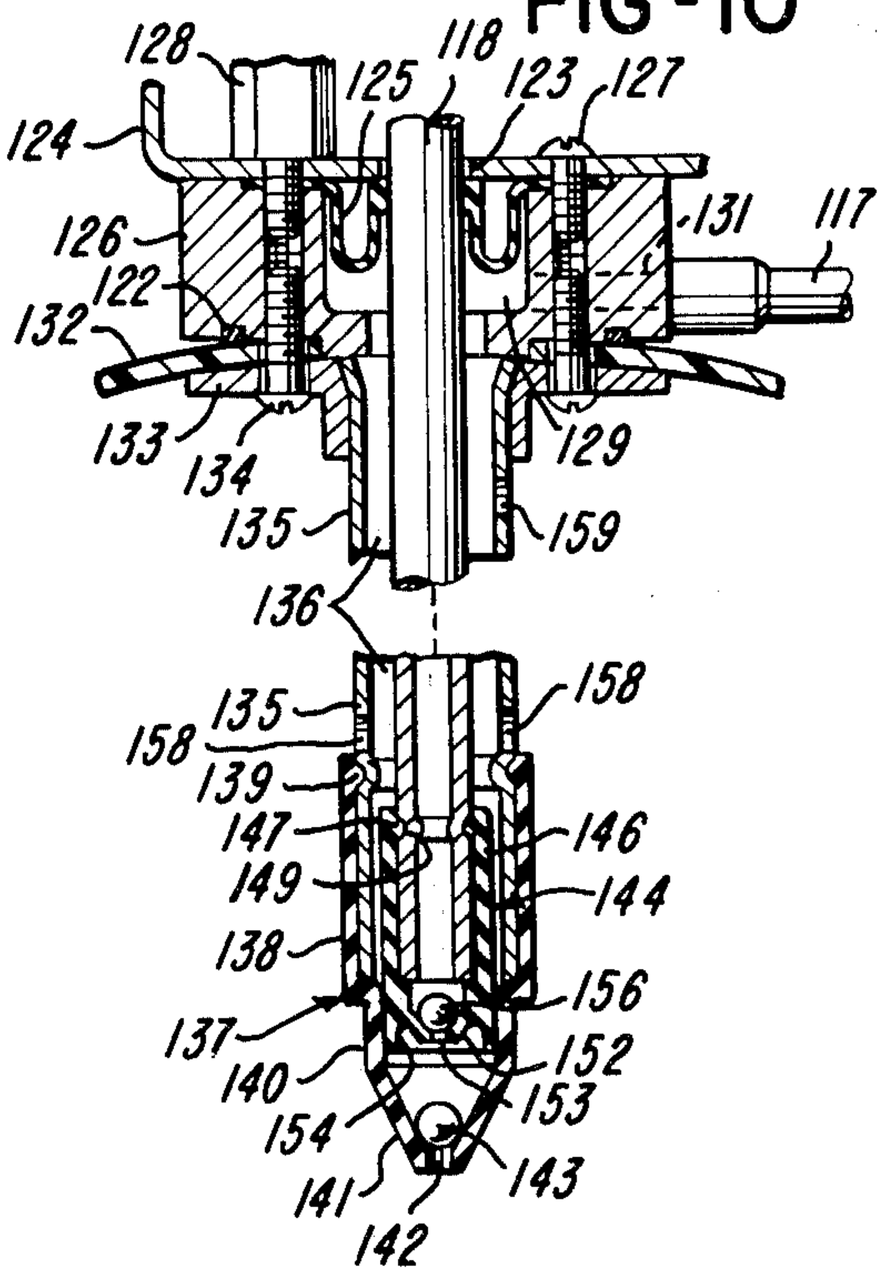


FIG-10



INK FOUNTAIN AND SUPPLY SYSTEM FOR A PRINTING PRESS

This is a division of application Ser. No. 411,283, filed Oct. 31, 1973 now U.S. Pat. No. 3,901,150

BACKGROUND OF THE INVENTION

In equipment or presses for printing articles such as a continuous supply of tickets, tags and labels, for example, as disclosed in U.S. Pat. No. 3,742,851 which issued to the assignee of the present invention, it has been found highly desirable to provide for precisely controlling the application of ink to the face of the printing plate mounted on the print cylinder so that precision lines or art work may be printed on the articles. For example, in recent years, a system has been developed for optically reading coded information printed on labels adapted to be attached to various products. Preferably, the machine readable coded information consists of a series of closely spaced parallel bars some of which are wide and the others of which are narrow. These bars must be precisely printed at a high speed, requiring a precise control over the amount of ink which is applied to the raised printing face of the printing plate. It is also important to supply the ink applying roll with a continuous supply of ink and to provide for recirculating the overflow or excess ink to the ink supply reservoir or container.

Various systems and mechanisms have been proposed or used for adjusting the position of an ink applying roll relative to a print cylinder which carries a printing plate. For example, U.S. Pat. No. 2,703,525 and No. 3,645,202 disclose two different types of such mechanisms. Furthermore, various systems and mechanisms have been proposed or used for supplying ink to the ink applying roll of a printing press and for returning excess or overflow ink to the ink supply reservoir or container. For example, U.S. Pat. No. 2,253,122, No. 2,869,460 and above patent No. 3,742,851 disclose different types of ink recirculating systems.

SUMMARY OF THE INVENTION

The present invention is directed to an improved system for applying ink to the face of a printing plate on a printing machine and which provides, as one important feature, an improved means for precisely controlling the amount of ink which is applied to the printing plate. In addition, the present invention provides an improved system for recirculating ink to the ink applying means. In accordance with the illustrated embodiments of the invention, the ink applying system incorporates a lower ink distributing roll which is positioned adjacent an upper ink applying roll in horizontally offset relation to define a nip zone for receiving a supply of ink. The rolls are driven in timed relation by a set of gears positioned at corresponding ends of the rolls, and the rolls are supported as a unit for precision adjustment at opposite ends relative to the print cylinder. The lower ink distributing roll is also adjustable relative to the ink applying roll to control precisely the film of ink carried by the ink applying roll to the face of the printing plate.

The ink distributing and applying rolls are positioned within a substantially enclosed ink fountain housing which receives a supply of ink from a recirculating reciprocating plunger-type pump system actuated by the same drive motor which rotates the print cylinder and the ink distributing and applying rolls. In the illustrated embodiments, the recirculating pump system includes a manifold and cap assembly which is adapted to receive a molded plastic ink bottle or container and which also supports a set of concentric ink supply and return tubes depending into the container. The lower end portions of the tubes support a set of corresponding concentrically disposed molded plastic check valve bodies which snap-fit onto the tubes.

In addition to the precision control of the application of the ink of the printing plate, the construction of the ink supplying and applying system provides for dependable service during high speed operation of the printing press. Furthermore, other features and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a printing press adapted for printing a continuous supply of labels and which incorporates an ink application system constructed in accordance with the invention;

FIG. **2** is a fragmentary section taken generally on the line **2—2** of FIG. **1;**

FIG. **3** is a section taken generally on the line **3—3** of FIg. **2;**

FIG. **4** is an end elevational view taken generally on the line **4–4** of FIG. **3** and with a portion broken away;

FIG. **5** is a section taken generally on the line **5—5** of FIG. **3;**

FIG. **6** is a section taken generally on the line **6—6** of FIG. **3;**

FIG. **7** is a fragmentary section taken generally on the line **7—7** of FIG. **6;**

FIG. **8** is a view similar to FIG. **4** and showing a modification of the invention;

FIG. **9** is an elevational view, in part section, of the ink recirculating pump system shown in FIG. **1,** with a portion of the ink supply container broken away; and

FIG. **10** is an enlarged fragmentary vertical section of the pump mechanism used in the ink recirculating pump system shown in FIGS. **1** and **9.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** illustrates a printing press **15** which is adapted to receive a roll **16** of a web or strip S of paper material and to print on the strip S a succession of tags or labels L such as, for example, the labels mentioned above having machine readable coded data or information represented by a series of closely spaced precision lines **18.** In general, the printing press **15** includes a housing **20** which supports a cross shaft **21** driven by an electric motor (not shown) enclosed within the housing **20.** The strip S is advanced by a feed wheel **22** mounted on the shaft **21,** and a type drum or print cylinder **24** (FIG. **2**) is positioned forwardly of the feed wheel **22** and is also driven by the motor. The cylinder **24** is adapted to receive a suitable printing plate (not shown) which is attached to the outer surface of the print cylinder, for example, by pressure sensitive adhesive.

An ink fountain assembly or unit **25** is positioned between a set of parallel spaced side wall extensions **26** forming part of the housing **20,** generally in front of the feed wheel **22** and the print cylinder **24.** As the strip S is repetitively printed to produce the successive labels L, the strip S is directed under the fountain unit **25** and is either rewound into a roll or fed through an optional knife cut-off unit **30** (FIG. **1**). The cut-off unit **30** is

supported by the housing **20** between the side wall extensions **26** and includes a lower stationary knife member **31** and an upper knife member **32.** The upper knife member **32** is reciprocated vertically in response to actuation of an eccentric mechanism within the unit **25.** The mechanism is driven by a shaft **34** which extends horizontally from a right angle gear box **36** (FIG. **1**) connected to a projecting end portion of the cross shaft **22.**

In accordance with the present invention, the ink fountain assembly or unit **25** includes a cover member **42** (FIG. **2**) which is secured by a set of screws **43** to a cross support member **44** having an inverted L-shaped configuration. The opposite end portions of the support member **44** are received within correspondingly shaped notches or recesses **47** formed within the side walls of the housing **20,** and are secured to the side walls by a set of lock screws **48.** Another set of adjusing jack screws **49** extend through threaded holes within opposite end portions of the support member **44** and the ends of the jack screws **49** contact the bottoms of the recesses **47** to provide for precise upward and downward adjustment of the fountain unit **25** when the lock screws **48** are released, as will be explained later.

A set of cast metal end brackets **52** and **54** (FIG. **3**) depend from opposite ends of the cover member **42,** and the brackets **52** and **54** support a set of aligned antifriction bearings **56** which support the end journals **58** and **59** of an ink applying roll **60.** The ink applying roll **60** includes a resilient outer coating or covering **62** (FIG. **2**) which has a smooth cylindrical outer surface for applying ink to the printing face of the printing plate mounted on the print cylinder **24.** A gear **64** (FIG. **3**) is mounted on the journal **58** of the ink applying roll **60** and is driven by a gear (not shown) secured to the corresponding journal of the print cylinder **24.** As mentioned above, the print cylinder **24** is driven by an electric motor enclosed within the housing **20.**

Another gear **67** (FIGS. **3** and **4**) is mounted on the opposite journal **59** of the ink applying roll **60** and is located within a recess **68** formed within the outer surface of the support bracket **54.** A set of channel-like grooves or recesses **71** (FIG. **6**) are formed within the inner surfaces of the depending support brackets **52** and **54** and slidably support a corresponding pair of support plates **72** (FIG. **6** and **7**). Antifriction bearings **76** (FIGS. **5** and **7**) are retained by the lower end portions of the support plates **72** and support the end journals **78** (FIGS. **5** and **7**) of an ink distributing roll **80** which has a precisionally ground hard outer surface. As best shown in FIG. **6,** the support plates **72** are positioned on a slight inclined angle relative to a vertical plane and support the distributing roll **80** in a position below and slighty forward (FIG. **2**) of the ink applying roll **60** so that movement of the support plates **72** controls the minute gap of a nip **82** (FIG. **2**) formed between the rolls **60** and **80.**

A gear **84** (FIGS. **4** and **7**) is mounted on one of the end journals **78** of the ink distributing roll **80** within part of the recess or cavity **68** formed within the corresponding support bracket **54,** and a set of idle or transfer gears **88** connect the gear **84** to the gear **67** mounted on the journal **59** of the ink applying roll **60.** The transfer gears **88** are mounted on corresponding shafts **89** which are supported by the adjacent support plate **72,** as shown in FIGS. **4** and **6.** Each of the depending support brackets **52** and **54** also supports a resilient rubber-like wiper member **92** (FIG. **6**) which engages the corresponding end surfaces of the rolls **60** and **80** adjacent the nip **82** for limiting an axial flow of ink from the nip.

Referring to FIG. **7,** each of the support plates **72** includes an inwardly projecting flange **94** which has a threaded hole for receiving an adjusting screw **96** positioned to engage the corresponding top end surface of the cover member **42.** Thus each end portion of the ink distributing roll **80** may be precisely adjusted independently relative to the corresponing end portion of the ink applying roll **60** by adjusting the corresponding screw **96** after a lock nut **97** (FIG. **7**) is released. As shown in FIGS. **2—7,** a generally rectangular pan-like container **100** encloses the ink distributing roll **80** and the end support brackets **52** and **54.** The container **100** has an upper edge portion which is secured to the cover member **42** by a series of peripherally spaced screws **103** (FIGS. **2** and **7**). The container **100** is provided with a tubular fitting **104** (FIG. **3**) which projects from a lower corner of the container and defines an ink return outlet for the container.

As shown in FIG. **2,** ink is supplied to the rolls **60** and **80** in the area of the nip **82** through a tubular fitting **110** which projects downwardly and rearwardly to substantially the center of the nip **82.** The tubular fitting **110** projects through a hole formed within the center of the cover member **42** and is secured to the cover member by a nut **111.** A flexible supply tube **112** connects the fitting **110** to an ink recirculating pump system **115** (FIG. **1**) which is supported by a formed sheet metal bracket or cover housing **116** secured to the adjacent side wall of the press **15.** The pump system **115** is capable of supplying ink to the tube **112** at a rate greater than the rate at which the ink is applied to the printing plate, and the ink which overflows from the ink distributing roll **80,** is collected within the container **100** and returned to the pump system **115** by a flexible ink return tube **117** which has one end connected to the tubular outlet fitting **104.**

Referring to FIGS. **9** and **10,** the ink recirculating pump system **115** includes a rigid vertical ink supply tube **118** having an upper end portion which receives the opposite end of the ink supply tube **112.** The flexible ink supply tube **112** extends through a resilient grommet **121** seated within a hole formed within the upper wall of the housing **116,** and the rigid ink supply tube **118** projects downwardly through a hole **123** (FIG, **10**) formed within an L-shaped bracket **124** secured to the cover housing **116.** A flexible bellows-like diaphragm or seal **125** is mounted on the tube **118** and has an outer peripheral portion clamped to the bracket **124** by an annular manifold **126** secured to the bracket **124** by a set of screws **127** and the threaded lower end portion of a stud **128.** The manifold **126** defines a center chamber **129** and has a radially extending passage **131** which connects the chamber **129** with the ink return tube **117.** The seal **125** permits the tube **118** to move axially while forming an air-tight closure for the chamber **129.**

A circular cap member **132** is secured to the lower portion of the manifold **126** by an annular collar **133** (FIG. **10**) and a set of screws **134.** An O-ring **122** forms a fluid-tight seal between the cap member **132** and the manifold **126.** The collar **133** supports the upper flanged end portion of a vertical outer ink return tube **135** which concentrically surrounds the tube **118** and defines an elongated vertical annular passage **136.** A molded plastic check valve housing or body **137** in-

cludes an upper cylindrical portion **138** which receives the lower end portion of the outer tube **135** and includes an inner peripheral bead **139** which snap-fits into a circumferential groove formed within the lower end portion of the outer tube **135.** The check valve body **137** also includes a reduced cylindrical intermediate portion **140** which integrally connects the upper cylindrical portion **138** to a tapered or frustoconical lower end portion **141** defining an inlet or opening **142.** A spherical valve member or ball **143** normally seats within the lower end portion **141** of the body **137** for normally closing the inlet **142.**

A piston member **144** is also formed of a molded plastics material and includes a cylindrical upper portion **146** which receives the lower end portion of the tube **118.** The cylindrical portion **146** has an internal peripheral bead **147** which snap-fits into a circumferential groove **149** formed within the lower end portion of the tube **118.** The piston member **144** also includes a lower frusto-conical end portion **152** having a center opening **153** and is surrounded by an annular skirt portion **154.** The skirt portion **154** fits closely within the cylindrical portion **140** of the housing **137** for sliding reciprocation movement. Another spherical valve member or ball **156** normally seats on the inner surface of the frusto-conical portion **152** of the piston member **144,** normally closing the opening **153.** A set of holes **158** (FIG. **10**) are formed within the lower end portion of the outer tube **135,** and vent hole or opening **159** is formed within the upper end portion of the tube **135.**

Referring to FIG. **9,** an actuating member or lever **162** includes a clearance hole for receiving the upper end portion of the tube **118.** The lever **162** has a downwardly projecting curved portion **163** which seats on a retaining ring **164** secured to the tube **118.** A compression spring **166** surrounds the tube **118** and abuts the retaining ring **164** and the bracket **124.** The inner end portion of the actuating lever member **162** has a hole for receiving the upper externally threaded end portion of the stud **128,** and a tubular nut **167** is adjustably mounted on the stud **128** to form a fulcrum for the lever member **162.**

As illustrated in FIG. **1,** the shaft **34** extends through or under the cover housing **116,** and a cylindrical cam member **168** is eccentrically mounted on the shaft **34** above the actuating lever **162.** Thus rotation of the cam member **168** is effective to pivot the lever **162** and reciprocate the inner tube **118** and piston member **144** within the surrounding corresponding outer tube **135** and valve body **137.** The concentric tubes **118** and **135** project downwardly or depend into a generally cylindrical bottle or container **175** which holds a supply of ink. Preferably, the container **175** is molded of a plastics material and has an integral upper neck portion **176** which threads into the cap member **132** secured to the manifold **126.** The container **175** is also supported by an inverted L-shaped support strap **178** having an upper leg portion secured to the bracket **124** and a lower end portion clamped to the container **175** by an adjustable hose-type band clamp **181.**

The ink supply system described above, operates in the following manner. A supply of ink is pumped to the fountain assembly or unit **25** through the tube **112** in response to the continuous rotation of the shaft **34** and cam member **168** (FIG. **9**) which reciprocates the tube **118** within the tube **135** by a preselected amplitude as determined by the adjustment of the tubular nut **167.** The reciprocation of the piston member **144** within the valve body **137** produces a continuous pulsating flow of ink from the container **175** through the openings **142** and **153** and upwardly through the ink supply tube **118.**

As the ink is supplied through the tube **112** (FIG. **2**), it forms a pool of ink ahead of the nip **82** and along the length of the rolls **60** and **80.** A film of ink is carried through the nip **82** by the roll **60** and is applied to the face of the printing plate secured to the print cylinder **24.** The ink which flows over the ink distributing roll **80** collects within the container **100** and is directed back to the recirculating pump system **115** through the tube **117.** The return ink flows downwardly through the annular passage **136** and out through te openings **158** within the lower end portion of the tube **135.** The vent opening **159** enables air to enter the container **175** above the ink supply and thereby prevent a partial vacuum for forming within the container **175.**

As mentioned above in connection with FIGS. **2–7,** the application of the ink onto the printing plate by the roll **60** may be precisely controlled by selectively adjusting the screws **49** and **96** for the opposite end portions of the rolls **60** and **80.** That is, by precisely adjusting each screw **49,** the corresponding end portion of the entire fountain assembly or unit **25** is adjusted generally vertically to control the pressure exerted by the roll **60** on the face of the printing plate and to obtain a uniform application pressure. In addition, each end portion of the ink distributing roll **80** may be precisely and independently positioned by adjusting the corresponding screw **96.** This adjustment feature provides for precisely positioning the ink distributing roll **80** relative to the ink applying roll **60** to control the film of ink carried by the roll **60** through the nip **82** and to assure that the film is precisely uniform along the entire length of the rolls **60** and **80.** As best illustrated in FIGS. **4** and **6,** the slightly inclined adjustable support plates **72** are positioned so that the transfer gear **88** engaging the gear **67,** moves in a direction substantially tangential to the gear **67** when the corresponding plate **72** is adjusted by the screw **96.** Thus the drive engagement between the gears is not effected by adjustment of the corresponding end portion of the roll **80** relative to the roll **60.**

Referring to the modification shown in FIG. **8,** in some ink application systems, it is desirable for the ink distributing roll **80** to rotate at a speed substantially slower than the speed of the ink applying roll **60.** To obtain this differential speed between the rolls **60** and **80,** a gear **67′** is mounted on the journal **59** of the roll **60,** and a substantially larger diameter gear **84′** is mounted on the corresponding journal **78** of the roll **80.** A set of transfer gears **88′** are supported by shafts **89′** and connect the gear **67′** to the gear **84′** to provide the lower speed rotation of the distributing roll **80** relative to the ink applying roll **60.** In a manner similar to that described above in connection with FIG. **4,** the gear **84′** and transfer gear **88′** are supported by the adjacent plate **72′** for linear adjustment within the channel **71** formed within the bracket **54′.** The opposite end portions of the roll **60** and **80** are supported in the same manner as described above in connection with the embodiment as shown in FIGS. **2–7.**

As illustrated in the drawings and described above, the ink applying roll **60** is precisely positioned to apply a uniform coating of ink to a printing plate mounted on the print cylinder **24.** However, it is to be understood that the roll **60** may also be used for applying ink to an intermediate ink transfer roll or roller such as, for ex-

ample, the traveling inking roller shown in above mentioned U.S. Pat. No. 3,742,851. Furthermore, while the forms of ink supplying and applying apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein, without departing from the scope and spirit of the invention as defined in the appended claims.

The invention having thus been described, the following is claimed:

1. An improved system for supplying ink from an ink supply container to an ink fountain of a printing press, said system comprising a pump including an elongated inner tube supported for reciprocating movement within an elongated outer tube, said inner tube defining a first fluid passage and said outer tube cooperating with said inner tube to define a second fluid passage therebetween, means for supporting said tubes within said container and defining a third fluid passage connected to said second passage, means defining an opening for connecting said second fluid passage with said ink supply container, a first conduit connecting said first passage to said ink fountain and providing for reciprocating movement of said inner tube, a second conduit connecting said third passage to said ink fountain, a set of corresponding check valves connected to the lower end portions of said tubes, means for reciprocating said inner tube within said outer tube to effect pumping of ink from said container through said first passage and said first conduit to said ink fountain, and said second conduit cooperates with said second and third passage to return excess ink from said ink fountain to said ink supply container.

2. A system as defined in claim **1** wherein said means for supporting said tubes comprise a manifold a cap member connected to said manifold, and said container is releasably connected to said cap member for supporting the ink supply.

3. A system as defined in claim **1** wherein at least one of said tubes has a recess within its outer surface, and the corresponding said check valve includes a valve body of molded material and having a portion which snap-fits into said recess.

4. A system as defined in claim **1** including a knife cutting unit adapted to cut a continuous strip of articles being printed by the printing press, and said means for producing said reciprocating movement of said inner tube comprise a drive mechanism which is also connected to drive said knife cutting unit.

5. An improved system adapted for supplying ink fluid to a printing press, comprising a set of inner and outer elongated tubes adapted to depend into a supply container of the fluid, means supporting said tubes for relative reciprocating longitudinal movement, a set of check valves mounted on corresponding lower end portion of said tubes, each of sid tubes including a peripheral recess within its outer surface, each of said check valves including a valve body of molded deformable material and having an integral securing portion which receives the lower end portion of the corresponding said tube, said securing portion of each valve body includes an inwardly projecting protrusion which snap-fits into the corresponding said recess to provide for rapid and convenient assembly of said valve bodies on said tubes and to facilitate periodic removal of said valves for cleaning, and means for producing relative reciprocating movement of said tubes for pumping the fluid upwardly through said inner tube.

6. A system as defined in claim **5** wherein said inner and outer tubes define a longitudinally extending passage therebetween, and means for directing fluid into said passage.

7. A system as defined in claim **5** wherein the lower end portion of each said tube has a peripherally extending groove, and said securing portion of each said valve body is generally cylindrical and has an inwardly projecting circumferential bead seated within said groove.

* * * * *